UF | UNIVERSITY of FLORIDA

Root-Knot Nematode Problems on Peach in Florida – Prevention and Management

Donald W. Dickson

Professor (Nematologist)

Entomology and Nematology Department, Gainesville, FL

30 April 2019

For a Successful Peach industry in Florida

a) Depends on rootstocks & scions suitable for Florida conditions.

b) Root-knot nematode resistant rootstocks.

c) How well the industry adapts to warmer, more erratic weather.

UF Effort to develop Peach Industry in Florida - Past 66 years

Rootstock Development

- Ralph Sharpe (began breeding to improved rootstocks and scions -- 1952)
- Wayne Sherman
- Jose Chapparo
- Tom Beckman -- USDA

UF Effort to Develop Peach industry

Outreach

- Mercy Omstead
- Ali Sarkhosh

UF Effort to Develop Peach Industry

Nematology input

- V. G. Perry, UF
- D. W. Dickson, UF
- Janete Brito, DPI
- Andy Nyczepir, USDA

Graduate Students

- Mary Ann Maquilan – graduated; breeding
- Omar Carillo-Mendoza - graduated; topic- tree architecture
- Kendra Blaker - graduated; topic- seed dormancy
- Dario Chavez - graduated; topic- genetic diversity in the germplasm
- Daniel Mancero-Castillo - graduated; topic- Botryosphaeria tolerance
- Todd Wert - graduated; topic- influence of climate on fruit development
- Benjamin Nichols - current student; advanced generation screening for other horticultural traits
- Zilfina Rubio-Ames - graduated; nitrogen fertilization
- Carlos Zambrano-Vaca – irrigation
- Sai Qui – graduated; nematology

Generating the segregating populations

1 Pollen collection (late Jan – early Feb)

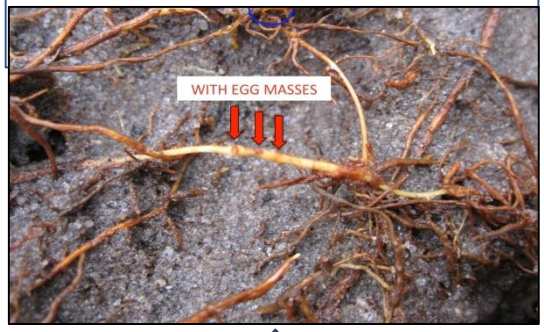
2 Manual pollinations (late Jan – early March)

3 Fruit harvesting & seed extraction (April – May)

4 Seed stratification and germination (Jun – Aug)

5 Growing plants in greenhouse (Sept – Nov)

6 Screening for peach root-knot nematode resistance



For a Successful Peach industry in Florida

In 1952, when rootstock breeding program began:

Turns out far more complicated than expected!

- Three species
  - Southern root-knot nematode
  - Javanese root-knot nematode
  - Peanut root-knot nematode

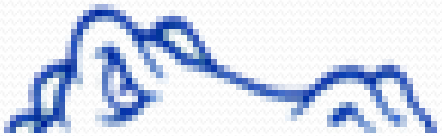
1949 Chitwood proposed 5 species

2019

14 Root-knot nematode species in Florida
Five of which are known pathogens of peach

Species	Species
M. incognita	*M. partityla*
M. arenaria	*M. graminis*
M. javanica	*M. graminicola*
M. floridensis #	*M. marylandi*
M. hapla	*M. christiei*
M. enterolobii ?	*M. cruciani*
M. haplanaria ?	*M. thamesi*

 # = Currently only reported in Florida and California.

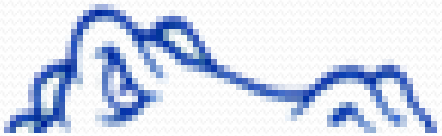


2019

Four species capable of breaking resistant genes in resistant plants.

Species	Common name
M. floridensis #	Peach root-knot nematode
M. enterolobii	Guava root-knot nematode
M. hapla	Northern root-knot nematode
M. haplanaria	Texas root-knot nematode

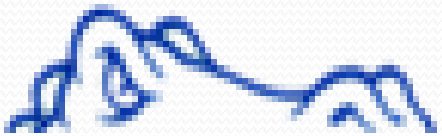
 # = Currently only reported in Florida and California.



Host races of root-knot nematodes

Species	Host Races
M. incognita	Four
M. arenaria	Four
M. javanica	Four
M. floridensis #	?
M. enterolobii	?
M. hapla	None reported
M. haplanaria	?

 # = Currently only reported in Florida and California.



Host Races identified by differential host tests

- Test includes six differential plants: (Taylor and Sasser, 1978):
  - Tobacco cv. NC 95
  - Cotton cv. Deltapine 61
  - Pepper cv. California Wonder
  - Watermelon cv. Charleston Gray
  - Peanut cv. Florida 07
  - Tomato cv. Agriset 334 (control)

- Inoculum required: 5,000 eggs & (or) second-stage juveniles per 6-inch pot

Peach rootstocks

Okinawa

Nemaguard

Nemared

Flordaguard *

MP-29

Guardian

Sharpe

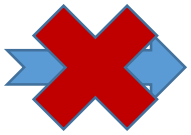
* Suggested rootstock for Florida. MP-29 rootstock also available.

Nemaguard and Nemared are reported to have resistance to:

Meloidogyne incognita

Meloidogyne javanica

Meloidogyne arenaria



Meloidogyne floridensis

Note: *Meloidogyne floridensis*, which is present in Florida, infects both Nemaguard and Nemared.

Sharpe et al. (1969). Journal of the American Society for Horticultural Science: 209-212.
Sherman and Lyrene (1983). Proceedings of the Florida State for Horticultural Society: 207-208.
Esmenjaud et al. (1997). Journal of Nematology: 370.
Fernandez et al. (1994). Hortscience: 1064–1067.

Okinawa is reported to have resistance to:

Meloidogyne incognita

Meloidogyne javanica

Meloidogyne arenaria

Sharpe, R. H. (1957). Proc Fla State Hort Soc, 320-322.
Sharpe et al., (1969). Journal of the American Society for Horticultural Science, 94: 209-212.
Sherman et al., (1981). Hortscience, 16:523-524.
de Paula et al., (2011). Revista Brasileira de Fruticultura, 33: 680-684.

Flordaguard is reported to have resistance to:

Meloidogyne incognita

Meloidogyne javanica

Meloidogyne floridensis

Sherman et al. (1991) Hortscience: 427–428.

Flordaguard is recommended to peach growers in Florida because of its broad-spectrum resistance.

However, field populations of root-knot nematodes exist that infect and reproduce on Flordaguard.

Flordaguard rootstock for Florida

- Flordaguard is the suggested rootstock for Florida peach production.
- This rootstock has the best source of root-knot nematode resistance currently available.
- Some field populations of root-knot nematodes, however, are known to exist that have the ability to infect and reproduce on Flordaguard.

Damage caused by RKN in peach

Tree stunting and reduced vigor are common visual symptoms to look for to diagnose root knot disease of peach.

‘Flordaguard’ peach rootstock

Shau Thai op Chico 11
(PI 65821)

Prunus davidiana
(C-26712)

x op H-91 op Fla. 12-9 op Fla. 17-64
outcross

either
(N.J. 5106137 x Okinawa)op
or
(Okinawa x Rancho 23/32)op

Fla. 4-115 op Fla. 14-11
(Flordaguard)

op = open pollination
x = unnumbered selection
N.J. 5106137 = J. H. Hale x (Elberta x Rutgers Redleaf)

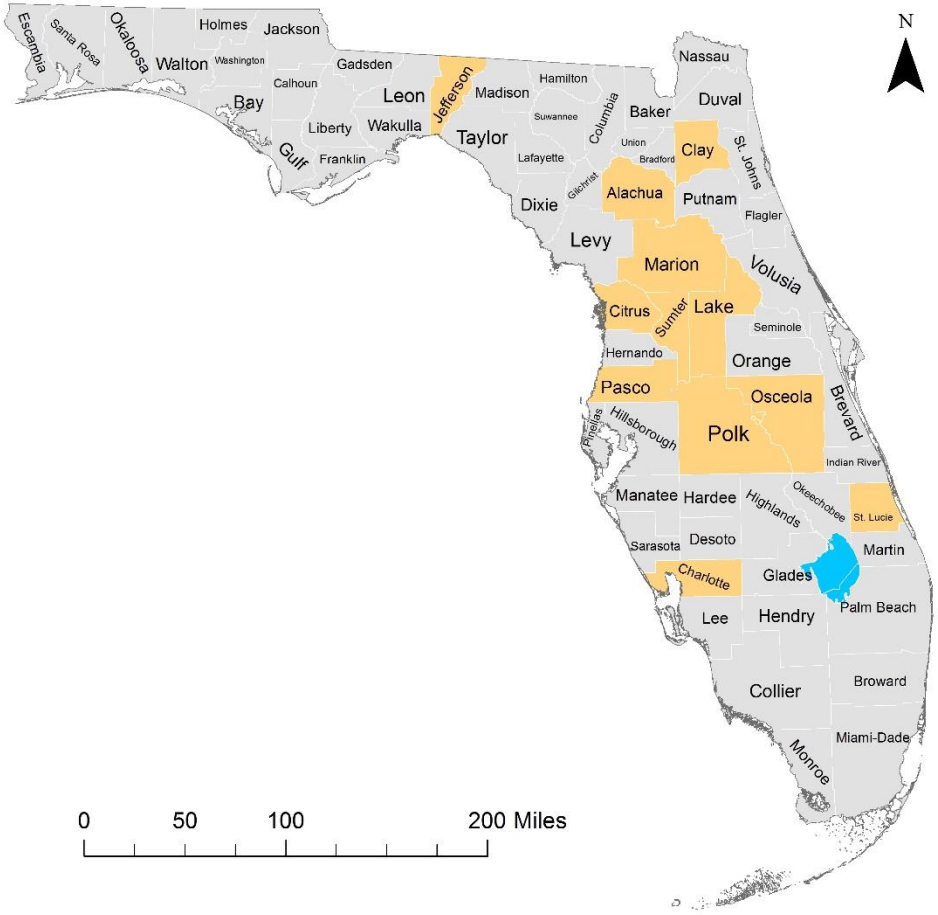
Photo credit: Mercy Olmstead

‘Flordaguard’ is the only rootstock suggested for peach production in Florida. It has the best source of root-knot nematode resistance currently available.

Root-knot nematode induced galls on Flordaguard rootstock.

‘Flordaguard’ peach rootstock with red leaves sprouting from below the graft.

Credit: Mary Ann Maquilan



Survey of peach orchards and nurseries in Florida. Counties sampled in yellow.

Survey Results – 25 Orchards

Common names	Percentages	Scientific names of species
Javanese root-knot nematode	68%	*Meloidogyne javanica*
Peach root-knot nematode	36%	*M. floridensis*
Peanut root-knot nematode	32%	*M. arenaria*
Southern root-knot nematode	8%	*M. incognita*

The percentages of each root-knot nematode type are based on 331 soil and root samples taken from 25 Florida orchards over a 2 year period.

Credit: Janete Brito

More than one species infecting peach. Mixture of species found in orchards in Florida

• Mixure of species	
M. arenaria	*M. javanica*
M. floridensis	*M. arenaria*
M. floridensis	*M. incognita*
M. floridensis	*M. javanica*
M. javanica	*M. incognita*

Credit: Janete Brito

Survey Results – 7 nurseries sampled

Six found with peach seedlings infected with:

Common name	Scientific names of species
Javanese root-knot nematode	*Meloidogyne javanica*
Peach root-knot nematode	*Meloidogyne floridensis*
Southern root-knot nematode	*Meloidogyne incognita*

Caution must be taken when purchasing peach seedlings. Talk with the nurseryman. Ask questions about the efforts taken to ensure peach seedlings are free of root-knot nematodes.

Damage on peach roots caused by root-knot nematodes.

Galled roots – A symptom that ensures peach roots are infected with root-knot nematodes. There is no cure once trees become infected.

Credit: Mary Ann Maquilan

Nurseries with peach rootstock infected with root-knot nematodes

Potted peach seedlings on ground cloth. Cloth will not prevent root-knot nematodes from entering pots and infecting peach roots.

Credit: Janete Brito

Nematode management options for important agricultural crops in Florida.

Legislative (quarantine)
- Prevention
- Avoidance

Nematicides
- Fumigants and nonfumigants
- New chemistries (Application methods, equipment, & dosages)

Cultural
- Rotation and cover crops
- Sanitation & clean planting stock
- Destruction of crop residue
- Time of planting
- Nutrition & general care of crop
- Trap & antagonistic crops
- Allelopathic plants

Host-plant resistance
- Conventional breeding
- Grafting
- Molecular innovations

Biological control
- Fungi & bacterial

Physical
- Heat
- Fallowing & flooding
- Solarization

For peach the best options for management is to begin with nematode-free planting stock, buy from a reputable nurseryman. Only purchase root-knot nematode resistant rootstock. Ensure plantings are well managed, proper nutrition and irrigation are important.


THANK YOU